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ABSTRACT

The accounting department at the University of Arizona, faced with numerous sections of introductory accounting, full classrooms, testing periods spread over two days, and a shortage of clerical help, evolved this testing program for the course in introductory accounting. Two objective multiple choice tests are constructed which sample different areas over the same course content. These two tests are used on alternate days. Two forms of each are prepared, with questions rearranged for the test to be used in alternate rows, so that students seated next to each other are answering the same test questions but in different order. Each instructor teaching the course contributes multiple choice items. One instructor, the test coordinator, prepares alternate test drafts, which are finalized at an instructors' conference. Students record their answers on IBM 1230 answer sheets, which are graded by the instructor and then analyzed by computer. Computer processing consists of the following steps: determining each student grade; computing the arithmetic mean and standard deviation for each test form; converting each grade to standard "T" scores with a mean of 50 and a standard deviation of 10; isolating the upper and lower quartiles; counting the various responses to the questions; determining the level of difficulty for each question; determining the power of discrimination for each item, and providing a printout by section and a printout for each test form. (KM)

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A TESTING PROGRAM
FOR
INTRODUCTORY ACCOUNTING

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A TESTING PROGRAM FOR INTRODUCTORY ACCOUNTING

Well-constructed tests are difficult to achieve under the best conditions. Individual teacher-made classroom tests are difficult to grade objectively. However, if the student population is large enough, a departmentalized testing program, using objective tests, can be initiated. An item analysis based upon these departmental tests should result in more valid and reliable test instruments and, consequently, more objective grades.

Teachers of introductory accounting courses are not in agreement regarding the best kind of test to use. Some insist that the problems type test provides a superior instrument for measuring student achievement because "Problems eliminate guesswork. They require a certain amount of familiarity with terms and forms, and they call for some analysis, organization and proper presentation."[1] The problem test typically consists of only a very limited number of questions; therefore, it is relatively easy to prepare. However, the sampling of course content is generally limited, and subjective scoring is slow, difficult, and often inconsistent.

On the other hand, the proponents of the objective test point out that this type of test provides for an extensive sampling of the course content due to the number of questions that can be included in a test, and that test scoring is quick, easy, and consistent. They further indicate that the objective test encourages the student to develop a comprehensive knowledge of specific facts and the ability to make fine discriminations among them. However, a relatively large number of questions is required for such a test, and its preparation is both difficult and time consuming.

The question of which kind of test to use often is further complicated by the number of students registered in the introductory accounting course. If the group is small enough to be enrolled in two or three sections, with only one or two teachers required the problem is minimal. On the other hand, when the number of students dictates the establishment of numerous sections with many different instructors, equitable testing and grading and the practical problems associated with testing multiple sections become an issue of sufficient magnitude to require consideration.

Practical complications frequently encountered are: fully occupied classrooms, making it necessary to administer alternate tests in alternate rows; inability to have a common testing time because of scheduling difficulties, making it necessary to spread the testing period over a minimum of two days; and finally, the shortage of clerical help to type, proofread, reproduce, and assemble tests.

The accounting department at the University of Arizona, faced with the complex situation of numerous sections of introductory accounting, full classrooms, testing periods spread over two days, and a shortage of clerical help, evolved the following solution.

Two objective multiple choice tests are constructed which sample different areas over the same course content. These two tests are used on alternate days. Two forms of each are prepared, with questions rearranged for the test to be used in alternate rows, so that students seated next to each other are answering the same test questions but in different order.

All test scores are converted to standard "T" scores, with a mean of 50 and standard deviations of 10 points. This conversion makes all test forms comparable as to difficulty and proves a grouping of grades by standard deviation for convenient and equitable grading.

The responsibility for test preparation is shared by all of the faculty members who are teaching the introductory course. Only multiple choice items are used, and each instructor contributes test items that are typed on 5 by 8 inch cards. The results of a subsequent item analysis are entered on the back of each card. One faculty member, designated as test coordinator, prepares alternate test drafts and distributes them to the various instructors for review. The test drafts are finalized at an instructor's conference.

The student's answers are recorded on IBM 1230 answer sheets. Thus it is possible to return the tests to the students and to have a timely critique of the test at the class meeting following the period the test was administered. The answer sheets are graded by the instructor, who enters the grade on the answer sheet. The answer sheets are then given to the test coordinator for preparation of a separate analysis of the four alternate test forms.

The first step in the test analysis is to run the answer sheets through an IBM Mark Sense Scanner wired to an IBM 534 key punch machine. This process step accomplishes two things. The machine counts the number of correct responses and prints the results on the margin of the answer sheet; then the machine transfers the student's identification number, section, instructor's grade, and responses to the various questions from the answer sheet to IBM cards. The cards are then turned over to the University of Arizona computer center for processing. The computer processing consists of the following steps.

1. Determining each student grade. This step confirms the teacher's grade and provides a basis for other computations.
2. Computing the arithmetic mean and standard deviation for each form of the tests.

3. Converting each student grade to standard "T" scores, which have a mean of 50 and a standard deviation of 10, using these formulas:

a) $Z \text{ score} = \frac{X - M}{SD}$ where X = any raw score

M = arithmetic mean of raw scores

SD = standard deviation of raw scores[2]

b) $T \text{ score} = 50 - 10(Z)$

4. Isolating the upper and lower quartiles. (Each of the alternate test forms is treated as a separate test in this analysis.)
5. Counting the various responses to the multiple choice questions.
6. Determining the level of difficulty for each question, using this formula:

$$\text{percentage right} - \frac{\text{percentage wrong}}{K\text{-}1}$$

where K equals the number of choices.

7. Determining the power of discrimination for each item, using this formula:

$$\frac{\text{number right in } Q^1 \quad - \quad \text{number right in } Q^4}{\text{number in one quartile}}$$

8. Providing a print-out by section for the instructors, with each student listed by matriculation number in ascending order. This print-out indicates the instructor's grade, the machine grade, the standard score, the incorrect responses, and the test form used by each student.

The test coordinator is also provided with a separate print-out for each of the test forms which contains the following information for each of the alternate test forms:

a) the number of responses to each choice for each question.

b) the level of difficulty of each question.

c) the power of discrimination of each question.

The results of the item analysis are entered on the 5 by 8 inch cards for future reference.

At the present time the questions are classified and filed for future use. When the number of questions is sufficiently large, tentative plans call for putting the questions and the results of the item analysis on computer memory tape. This will make it possible to recall from the memory bank questions of desired difficulty and discriminating power and prepare tests for which approximate standards have been established.

This testing program is the result of the efforts of a number of people. The accounting department provided the basic framework of an established departmental testing program. The personnel at EPIC Evaluation Center, Tucson, Arizona, supplied valuable technical assistance in basic test analysis procedures. Dave McQueeny, Computer Center, University of Arizona, wrote the program for the CDC 6400. In addition, Mr. Thomas Campbell, former graduate student, now with the Phoenix office of Arthur Anderson, rendered much valuable assistance and many long hours of painstaking labor during the formative stages of the program.

[1] *A Guide to Accounting Instruction: Concepts and Practices*, 2nd ed., American Accounting Association (Cincinnati, Ohio 1968), p. 129.

[2] Norman E. Cronlund, *Measurement and Evaluation in Teachings*, (New York, 1965), pp. 288-89.